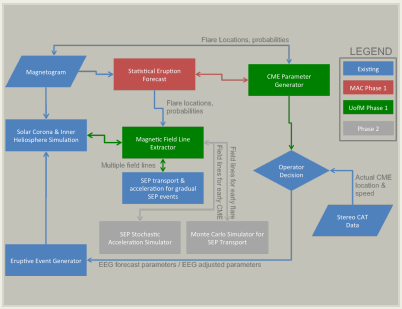
Small Business Innovation Research/Small Business Tech Transfer

Improved Forecasts of Solar Particle Events using Eruptive Event Generators based on Gibson-Low and Titov-Demoulin Magnetic Configurations, Phase I

Completed Technology Project (2015 - 2016)

Project Introduction

Radiation hazards constitute a serious risk to human and robotic space operations beyond Low-Earth orbit. Primary contributors to space radiation include Solar Particle Events (SPEs) associated with Coronal Mass Ejections (CMEs). Because the mechanisms that produce coronal mass ejections (CME) are exceedingly complex, no reliable deterministic methods for predicting eruptions are yet available, and the most successful approaches are phenomenological and probabilistic in nature. But predicting the eruption is only part of the problem. In order to forecast the time, location, flux, and the energy spectrum of a Solar Particle Event (in order to better model its effect on specific hardware and instruments, for example) we must also understand the intervening plasma environment, including the steady-state magnetic configuration, as well as the dynamic, eruption driven configurations that provide for the time dependent transport and diffusive acceleration of solar energetic particles. Progress has been made in the understanding of the solar atmosphere due to the increased availability of observational data and the development of analytical and numerical models of the solar wind. One aspect of this development is the construction of complex three-dimensional (3D) models, which can be validated with observations and further refined to improve the comparison. In order to improve SPE forecasts Michigan Aerospace Corporation (MAC) and the University of Michigan's department of Atmospheric, Oceanic, and Space Science (AOSS) intend to cooperate on this STTR project, which seeks, over Phase 1 and Phase 2, to 1) Use data-driven statistical models to forecast the likelihood of solar eruptions; 2) Couple these predictions with eruption generation models in the context of the Space Weather Modeling Framework (SWMF) to forecast the likely time, location, flux, and energy spectrum of Solar Energetic Particles.



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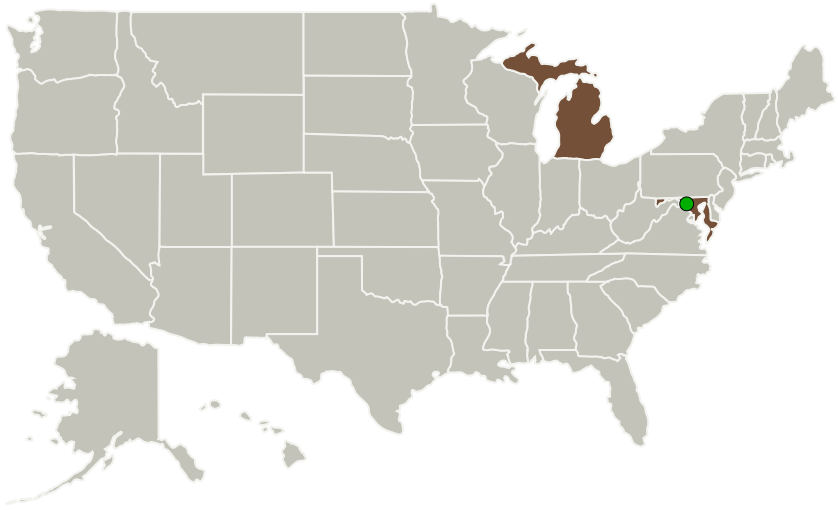
Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
Michigan Aerospace Corporation	Lead Organization	Industry	Ann Arbor, Michigan
Goddard Space Flight Center(GSFC)	Supporting Organization	NASA Center	Greenbelt, Maryland

Primary U.S. Work Locations	
Maryland	Michigan

Project Transitions

June 2015: Project Start

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

Michigan Aerospace Corporation

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

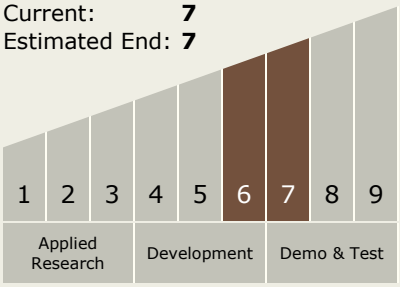
Carlos Torrez

Principal Investigator:

Matthew Lewis

Technology Maturity (TRL)

Start: **6**
Current: **7**
Estimated End: **7**



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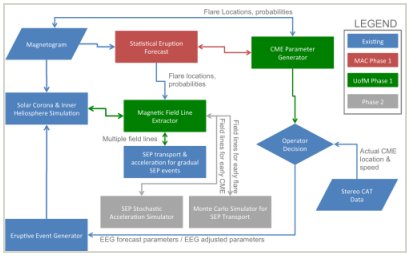
June 2016: Closed out

Closeout Summary: Improved Forecasts of Solar Particle Events using Eruptive Event Generators based on Gibson-Low and Titov-Demoulin Magnetic Configurations, Phase I Project Image

Closeout Documentation:

- Final Summary Chart Image*(https://techport.nasa.gov/file/139098)*

Images



Briefing Chart Image
Improved Forecasts of Solar Particle Events using Eruptive Event Generators based on Gibson-Low and Titov-Demoulin Magnetic Configurations, Phase I *(https://techport.nasa.gov/image/135272)*

Technology Areas

Primary:

- TX06 Human Health, Life Support, and Habitation Systems
  - TX06.5 Radiation
    - TX06.5.4 Space Weather Prediction

Target Destinations

The Sun, Earth, The Moon, Mars, Others Inside the Solar System, Outside the Solar System